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Systems Theory as an Ideology

BY ROBERT LILIENFELD

> In principle, we have the technological capability of adequately feeding, sheltering, and clothing every inhabitant of the world. . . . In principle, we have the technological capability of providing adequate medical care for every inhabitant of the world. . . . In principle, we have the technological capability of providing sufficient education for every inhabitant of the world for him to enjoy a mature intellectual life. . . . In principle we have the technological capability of outlawing warfare and of instituting social sanctions that will prevent the outbreak of illegal war. . . . In principle we have the capability of creating in all societies a freedom of opinion and a freedom of action that will minimize the illegitimate constraints imposed by society on the individual. . . . In principle, we have the capability of developing new technologies that will release new sources of energy and power to take care of physical and economic emergencies throughout the world. . . . In principle, we have the capability of organizing the societies of the world today to bring into existence well-developed plans for solving the problems of poverty, health, education, war, human freedom and the development of new resources. . . . If the human being has the capability of doing all these things, why doesn't he do it? . . . . The answer is that we are not organized to do so.[1]

So begins a work introducing the "systems approach" to the solution of the world's problems. In this essay, we will examine this approach as an intellectual movement and as an applied science that has had an impact on every level of American government—Federal, state, and municipal—and which has attracted the attention of the socialist world.

At an intellectual level this movement claims to present a world

[1] C. West Churchman, *The Systems Approach* (New York: Dell Publishing Co., 1968), pp. 3–4. There was another treatise that began with the words *In principio,* but it was less ambitious.

view which transcends the limitations of any one scientific discipline, and recasts the problems of sociology, psychology, ethics, cosmology, and the physical sciences. Beginning as a set of techniques applied to a number of separable disciplines, in which these techniques were originally quite narrow, specific, and specialized, the systems movement has steadily widened its scope, and has produced a popularizing literature that excludes nothing from the systems view.

The Disciplinary Origins of Systems Thinking

Systems theorists claim that their view of the world originated in a number of different sciences, that their affinities quickly became evident, and that their convergence into a general systems movement provides for a new world view. These originally separate fields included biology, cybernetics, economics, communications and information theory, and operations research. In each case, a cohort of sociologists, political scientists, and city planners identified with the systems approach and defined its jurisdictional boundaries. The systems movement, over a period of twenty-five years, became a broad river into which many tributaries flowed. The major tributaries included the following:

The Biologism of Ludwig von Bertalanffy. Bertalanffy (1901-1972) began his career as a scientist, making contributions from the 1920s on to theoretical biology. Bertalanffy had long maintained that the methods of the physical sciences were inappropriate to biology, whose phenomena call for new ways of thinking. Organic laws required a new mathematics and a new statistics, as the mathematics and statistics currently existing had been developed for the physical sciences and their mechanistic concepts. His 1950 essay, "The Theory of Open Systems in Physics and Biology," became the basis for a new movement of thought, for which he probably deserves the title of father of the general systems movement. As he began to generalize his image of the sys-

tem, his philosophical interests overshadowed the scientific element in his writings. In this essay, Bertalanffy stated the reasons why new methods were called for:

- The characteristic state of a living organism or cell is that it is an *open system,* that is, it exchanges matter and energy with its environment; it maintains not a mechanical equilibrium but a *steady state.*
- Physics for the most part deals with closed systems. According to the second law of thermodynamics, a closed system must eventually become disorganized; this is what is meant by entropy. But living systems exhibit *negative entropy,* that is, they become more and more organized and differentiated, importing energy from without in order to develop and maintain themselves.
- Not only do open systems maintain themselves in steady states; their metabolism maintains a constant ratio of components in a continuous flow of materials; thus, they are self-regulated.
- Open systems exhibit the property of *equifinality* which is not found in closed (mechanical) systems. In a closed system, a change in initial conditions produces a change in final conditions; but in some embryos, the transplantation of cells, if made early enough, leads to the same final result as would obtain if the cells had not been transplanted; the fully developed animals are identical.

On the basis of these considerations, Bertalanffy called for the development of new ways of thinking, new mathematics and statistics, to deal with these phenomona. In 1954, he and such scholars as Kenneth Boulding and Anatol Rapoport founded the Society for General Systems Theory, later changed to the Society for General Systems Research. Their purpose was to explore and promulgate the tenets of systems thinking.[2] The idea of applying the image of the open system to societies and social organizations

[2] Bertalanffy's general views are expressed in his *General Systems Theory: Foundations, Development, Applications* (New York: G. Braziller, 1968). His essay on the open system is reprinted in F. E. Emery, ed., *Systems Thinking* (Baltimore: Penguin, 1969).

soon presented itself to systems thinkers, and this branch of the systems movement has developed a large literature of works in philosophy and the social sciences. Bertalanffy extended the scope of systems concepts to include the possibility of explaining the nature of man, society, language, and human history. He further argued that such disciplines as operations research, communications theory, cybernetics, information theory, and modern linguistics were all subdisciplines of general systems theory (GST). The purpose of GST was to develop broad overarching concepts applicable to all fields, and to show that conceptual models fruitful in one field were transferable to other fields. GST would discover the laws that apply to any system, whether it be the living organism, the network of life, a society, an economy, or a language.[3]

Bertalanffy's associate, Ervin Laszlo, has attempted to carry out this program in an ambitious series of publications.[4]

Cybernetics: Norbert Wiener and W. Ross Ashby. Norbert Wiener's mathematical work on cybernetics established both his fame and cybernetics itself as a new discipline. The central notion of cybernetics is that of *feedback,* that is, that the performance of a machine may be corrected and guided by information about its own performance. The simplest illustration of feedback is the thermostat which controls room temperature by its own response to changes in temperature. Such a machine contains performance units and also sensory and control units, and a built-in logic. Wiener found special significance in the development of machines exhibiting "artificial intelligence," that is, computers programmed not merely to play chess or checkers but to learn from their experiences (that is, to record results of past games) and so to become

[3] For fuller documentation than space allows here, see my forthcoming *The Rise of Systems Theory: An Ideological Analysis* (New York: John Wiley and Sons), in which I examine all aspects of the systems movement.

[4] Laszlo's ambitious publications include the following: *Introduction to Systems Philosophy: Toward a New Paradigm of Contemporary Thought* (New York: Gordon and Breach, 1972); *The Systems View of the World: The Natural Philosophy of the New Developments in the Sciences* (New York: G. Braziller, 1972); *The Relevance of General Systems Theory* (New York: G. Braziller, 1972); and *A Strategy for the Future: The Systems Approach to World Order* (New York: G. Braziller, 1974).

better at them. Though such developments are still in their infancy, Wiener considered them of worldwide importance; man had now made intelligent creatures just as God had made man, and just as God has had to wrestle with his wayward creatures, so may man find the intelligent machine causing unforeseen difficulties.[5]

Wiener's work on the mathematical bases of cybernetic devices convinced him that the functioning of living individuals was paralleled by the functioning of these newer cybernetic communication devices. In his metaphor, animals have sensory inputs, memory units, "instructions" in the form of instincts or learned patterns of behavior, and they also have "outputs" in the form of behavior governed by feedback. Like Bertalanffy, Wiener felt that the term "life" implied all those phenomena which "locally swim upstream against the current of increasing entropy." The nervous system and the automatic machine are fundamentally alike in that "they are devices which make decisions on the basis of decisions they have made in the past." This notion of governance by means of communicating information about performance led Wiener to extend the concept of information. This too is "antientropic" in that it consists of meaningful patterns which "struggle" against the dissolving forces of static. In fact, a living creature is merely an organized pattern of information conveyed by its genes to the matter which is organized in creatural form, Just as a message is a pattern that imposes itself upon the chaos of "noise," so is an organism. There is no theoretical difference between the two.

Wiener drew the conclusion that, as the network of communications extends itself more efficiently over the world, world society can knit itself into an organic whole. Wiener maintained, without suggesting how it could be done, that cybernetics and communications theory could solve problems of substantive justice, presumably by clarifying communications which irrational emo-

[5] Norbert Wiener, *The Human Use of Human Beings* (Garden City: Doubleday Anchor Books, 1954); *God and Golem, Inc.* (Cambridge: The MIT Press, 1964).

tions, traditions, and interest groups prefer to keep obscure. He saw that the concept of cybernetic control through feedback might emerge as a model for how governments could operate, or at least how they might legitimize their operations, and he felt that the potential for the misuse of such power could easily be controlled by giving responsibility to "the anthropologist and the philosopher . . . we must know as scientists what man's nature is and what his built-in purposes are, even when we must wield this knowledge as soldiers and as statesmen; and we must know why we wish to control him." [6]

W. Ross Ashby's work in cybernetics has striven to incorporate modern communications theory and information theory into cybernetics, to the point where these terms have become virtually interchangeable. His major work is the effort to develop a terminology and mathematics suitable for demonstrating how self-regulating systems are possible, and to extend his claim to show that living creatures, societies, machines, and the living brain itself operate along cybernetic lines. For Ashby, a system is a set of variables which encompass the total past behavior of a machine or animal, as that behavior has been recorded. Thus the inner workings of the animal, machine, or person need not be known; it is a "black box," known through a complete listing of its past behaviors. From this, cybernetics moves to a concern with "isomorphisms," the cybernetic patterns which are exemplified by different systems.

Thus Ashby seems at times to refer to systems as concrete men, machines, and animals, at other times as sets of equations, axioms, and assumptions, and still at other times as correspondences and resemblances between them.[7]

Artificial Intelligence, Information, and Communication Theory. Scientists such as Donald MacKay, Claude Shannon, Warren

[6] Wiener, *The Human Use of Human Beings*, p. 182.

[7] Ashby's major popularizing works are: *An Introduction to Cybernetics* (London: Chapman and Hall, 1956), and *Design for a Brain*, 2nd ed. (New York: John Wiley, 1960).

Weaver, W. S. McCulloch, and Walter Pitts have attempted to understand human intelligence and the brain through constructing logic systems embodied in computer models or in models of nerve networks. Shannon was among the first to work out the electrical circuitry corresponding to logical operations. These scientists have suggested that logical propositions could be represented by the kinds of neural networks found in the brain. They assume that logical concepts are literally embodied in neural networks, and might even be regarded as epiphenomena of natural patterns.[8] Thus they have attempted to create machines which "think" by exploring algorithmic processes, which "recognize" geometric patterns through the sensing of light, and which "feel" by classifying inputs as "frustrating," "painful," or "satisfying." These machines are intended also to "learn" by experience, through signals which indicate suitable or unsuitable responses. Thus they intend to mechanize subjective life, thereby imparting it to these machines. Such machines are designed in hopes of multiplying intelligence in a manner analogous to the multiplication of human muscle power by bulldozers and the like.

Economics: Game Theory and Input-Output Analysis. Economists too have contributed to the systems view of the world. Perhaps the first attempt at an economic model of a society was the Tableau Economique of the Physiocrats, which modeled the total economy of France, developing a scheme showing the total flow of income from each sector to all others. Such schemes are perennial in economics, and twentieth-century economists have added their share. Two are especially important: the game theory

[8] The literature here is quite large. Some sources: Colin Cherry, *On Human Communication* (Cambridge: The MIT Press, 1966); Claude E. Shannon and Warren Weaver, *The Mathematical Theory of Communication* (Urbana: University of Illinois Press, 1972); Walter Fuchs, *Cybernetics for the Modern Mind* (New York: Macmillan, 1971); Donald M. MacKay, *Information, Mechanism and Meaning* (Cambridge; The MIT Press, 1969). Jagjit Singh's *Great Ideas in Information Theory, Language and Cybernetics* (New York: Dover Publications, 1966) provides a useful summary of this literature.

of Morgenstern and Von Neumann, and the input-output analysis of W. Leontief.

Von Neumann and Morgenstern took as their starting point a hypothetical situation in which a few business firms dominate a field, and plan out their competitive strategies for marketing, advertising, sales effort, and the like. From their attempts to discover the mathematical foundations of strategies under such conditions grew their theories of two- and three-person games, complete with tables of strategies and payoffs. Given certain simplifying assumptions, long-term strategies could be recommended on a mathematical basis. Where three or more firms (or persons) compete, a new element enters in the form of the possibility of coalition-formation based on the rewards demanded by the weaker competitors. Once coalitions are formed, the mathematics of the two-person game applies.

It is generally agreed that game theory had little value in economics, but its entire symbolic apparatus has been enthusiastically adopted by political scientists in discussing the strategy of U.S.A.-U.S.S.R. rivalry and in writing "scripts" for international confrontations, as well as in the analysis of election-campaign strategies.[9]

Leontief's input-output analysis seeks to analyze the relations between all sectors of an economy, such as the contribution to and requirements from such sectors as agriculture, textiles, and the rest. The problem exists on two levels: the first involves gathering enormous amounts of empirical material recording the transactions between all sectors of the economy; the second involves mathematical analysis of these interactions in order to answer such questions as how to determine what increased inputs from labor, housing, transportation, and the rest will be needed to increase, say, steel output by 20 per cent. Answers to these questions are

[9] See Morton Davis, *Game Theory: A Nontechnical Introduction* (New York: Harper Torchbooks, 1973); John Von Neumann and Oskar Morgenstern, *Theory of Games and Economic Behavior* (New York: John Wiley, 1967); Thomas C. Schelling, *The Strategy of Conflict* (New York: Oxford University Press, 1973); and Anatol Rapoport, *Fights, Games and Debates* (Ann Arbor: University of Michigan Press, 1960).

devised by the use of simultaneous equations involving hundreds of variables; the matrix algebra involved can be done only by large computers. Thus input-output analysis, like its close relative, linear algebra, offers itself as an instrument for the determination of social policy.

Operations Research and Systems Analysis. Operations research began in Great Britian in the preparations for the war of 1939–45 as an outgrowth of the development of radar. British scientists working with the Royal Air Force developed what we would now call a systems approach to the use of radar installations, in that these installations and defensive fighter squadrons were used in a coordinated rather than a piecemeal way. The approach spread to other military units of the British navy and army, and then to American military units. Operations research was then applied to the design and evaluation of weapons, especially in relation to their human users, and to the analysis of tactics. Its scope was then widened to include prediction of the likely outcomes of future tactical and strategic operations, and finally it was applied to the study of the efficiency of entire organizations engaged in military operations.[10] As operations research came to be applied to ever more ambitious studies, the term "systems analysis" gradually replaced the term "operations research."

Later, the statistical and quantitative techniques developed in wartime proved fruitful in major industrial fields, especially those involving advanced technology such as oil, chemicals, and electronics. In 1957 the International Federation of Operations Research Societies was founded, which event symbolized the emergence of a new profession. By now the number of journals and publications in this field is very large, with contributors from all over the world.

The primary concern of operations researchers is that of utilizing a system at "optimal" values, that is, with a minimum waste

[10] See Philip M. Morse, "The History and Development of Operations Research," in Grace J. Kelleher, ed., *The Challenge to Systems Analysis: Public Policy and Social Change* (New York: John Wiley, 1970).

of resources. Related to these ends are techniques like operational gaming, similar in structure to board games, in which strategies are played out by opposing teams.

Beginning in the 1960s, operations researchers left the relatively limited spheres of the efficient operation of oil refineries and the like and turned their attention to the solution of social problems such as urban decay, overpopulation, food production, the improvement of educational systems, and the "delivery" of health services to appropriate "target populations." Systems analysts, then, have brought their techniques into the realm of society as a whole.

Systems Theory as a Social Movement and as a Social Philosophy

Systems theorists claim to offer not merely new techniques, not merely a new world view, a new understanding of man and his environment, but also to provide the tools for remaking the world along technocratic-utopian lines.

Like other ideological movements, this one has developed a central doctrine and a syncretistic or ecumenical way of thinking. The various systems disciplines briefly described above have converged, and their practitioners now indicate that they are all branches of the same stem. A large and ambitious synthesizing literature has appeared.[11] Thus the cyberneticians have incorporated information and communications theory; the econometricians have borrowed cybernetic terminology, and both have utilized Bertalanffy's notion of the open system. The brain is a computer and the computer is a brain; the brain-computer can assimilate the social world and its relevant variables, can compute the relations between these variables, so as to simulate or predict

[11] Among philosophers, see Stephen C. Pepper, *World Hypothesis* (Berkeley: University of California Press, 1942) and *Concept and Quality: A World Hypothesis* (La Salle, Ill.: Open Court, 1967). Ervin Laszlo's works have been referred to above. See also Jay W. Forrester's *World Dynamics* (Cambridge: Wright-Allen Press, 1971).

the likely outcome for any particular mix of variables that one may specify. The computer—and those who run it—becomes a guide for making social policy. Given a set of goals, the systems theorists claim to be able to supply the proper mix of socioeconomic inputs that will achieve these goals—appropriate levels of population and economic growth, investment policy, employment levels, transportation systems, communication and record systems, and the like—and so produce the maximum reading on the "quality of life" index, which is the central variable of concern for those who make policy.

Sociologists, political scientists, psychologists, social workers, and psychoanalysts have begun to proclaim the importance of systems thinking; things are interrelated, and should not be analyzed in isolation; this discovery somehow makes all the difference. Talcott Parsons and Walter Buckley speak cybernetic; in political science, Karl Deutsch and David Easton; games theorists analyze international power struggles in systems terms; city planners, psychotherapists, and caseworkers have learned about feedback and the interchange of energy between open (social) systems and their environments. Even the subintellectuals of the Federal bureaucracy have climbed aboard with their own contribution, something called the Social Indicators movement; in January 1969, the Department of Health, Education and Welfare published a document called *Toward a Social Report,* evidently written by a committee including such figures as Daniel Bell, Raymond Bauer, William Bowen, James Coleman, Otis Dudley Duncan, Philip Hauser, Samuel Lubell, Daniel Moynihan, Neil Smelser, and others. This publication is based on the belief that quantitative measures can serve as indicators of the well-being of the nation. The systems-thinking aspect of this movement is more explicitly expressed in the volume edited by Raymond A. Bauer, *Social Indicators.*[12] Social indicators, however, appear to be no more than old-fashioned descriptive statistics dressed up in the rhetoric

12 Raymond A. Bauer, ed., *Social Indicators* (Cambridge: The MIT Press, 1966).

of systems analysis; the cost-of-living index could qualify as a social indicator, especially if it could measure not merely the cost but the quality of living.

Thus a full-scale intellectual movement has emerged, making large claims. But the literature of this movement remains vague, general, and programmatic. New beginnings and new insights are proclaimed, with little attention paid to the concrete world of human history or to the actual effects of systems theory when it is applied.

Systems Theory in Action

The systems literature contains very little material drawn from the real world; most of its commentaries refer to one another. But recently this movement has begun to be examined in terms of its practical impact upon the world. Several studies, all of interest, suggest that the systems do not work out quite as they are proclaimed.

Robert Boguslaw's *The New Utopians* [13] first pointed out the utopian-authoritarian possibilities of systems theory, and so deserves mention, but it too contains no empirical material. Nevertheless, Boguslaw foresaw much of the future development of the movement, though perhaps overestimating the effectiveness of system design.

But two recent studies provide evidence that the systems fail to perform even according to their own standards, and a third study exposes the defective logic underlying much systems thinking.

Ida R. Hoos's *Systems Analysis in Public Policy* [14] restricts its focus to systems analysis in the operations-research sense of the term, and examines its impact on American politics. Hoos traces

[13] Robert Boguslaw, *The New Utopians* (Englewood Cliffs: Prentice-Hall, 1965).

[14] Ida R. Hoos, *Systems Analysis in Public Policy* (Berkeley: University of California Press, 1972). Space limitations prevent the full discussion that this important work deserves.

the growth and spread of the systems approach through every level of American politics, culminating in Lyndon Johnson's 1965 directive introducing systems analysis into the Federal government, under the varied names of PPBS (Planned Programming Budgeting System), cost-benefit analysis, and the like. Since then, this approach has spread to almost every level of state and local government. Hoos draws her case studies for the most part from the experience of the State of California, which commissioned a large number of systems studies for application to such social problems as transportation planning, crime control, sewage disposal, public health, and education.

In some instances the systems men were simply unable to come to grips with the concrete realities, and so retreated into methodological refinements. In 1968, the California State Department of Health contracted with Aerojet General Corporation to the tune of $175,000 to do a cost-benefit model of solid-waste management in the Fresno area that would be usable elsewhere. The funding came in large part from HEW. The systems men were to develop not only an "optimum system" for the management of solid wastes in the Fresno area, but also a technology that would be applicable for other regions throughout the nation. More than eighteen "models" were developed, and costs in 1967 dollars were projected to the year 2000. Since there were no standards or guidelines for these problems, the engineers set out to develop some by interviewing thirty-nine persons employed in state and county health departments. They asked interviewees to rate waste materials with reference to thirteen categories of hazard, including flies, water pollution, rodents, odor, and the like; about three persons were interviewed for each bad effect. In Hoos's words:

> . . . the number assignments . . . although actually resulting in an ordinal scale, were henceforth treated and manipulated as though they had . . . a ratio scale. The "hard data" were nothing but a crystallizing of the hastily contrived catalogue . . . into arbitrary and overlapping categories through an artificial weighting procedure in which three individuals . . . were taken to represent the total community attitude. This was patently a parody of public

> opinion polling, itself not an undisputed means of gathering data. The perpetrators of this methodologically nonsensical approach to a serious problem apparently failed to recognize either the simplistic solutions they were inviting . . . or the invitation to . . . public relations-style treatment of the matter, that is, to manipulate people's attitudes and ignore the problem.[15]

Hoos notes that target dates in the twenty-first century are popular among systems analysts in many fields, giving as they do opportunities for more and more data-gathering and processing, for the manufacture of projections and extrapolations, and serving, of course, to postpone the day of reckoning.

Another instance was North American Aviation's *California Integrated Transportation Study* (1965), which ignored its charge to solve transportation problems and instead presented a utopian image of trains gliding through tubes at jetliner speeds, perhaps far below surface steets and countryside; of ships "flying" a few feet over the waves at several hundred miles per hour, only to nestle gently at a dock to exchange vast amounts of cargo in short times compared to today's airplanes; of trucks and buses riding on cushions of air over guideways, moving between cities at several times today's cruising speeds. Somehow it never came to grips with California's current transportation problems. Instead the study team

> gamboled in Elysian fields, where, thanks to . . . automation, the office employee of tomorrow could schedule his five hours of work at any time within a twelve-hour period, perhaps within the confines of his own home in the foothills of the Sierras or on the coast of Northern California . . . . Notably lacking in the idyllic scenario was concern for the blue collar or day worker who lived not in the sylvan shade of the mountains but in the lurking shadow of a slum, where bus service was poor and after-dark travel a peril. Completely forgotten was the original charge, viz., a plan to get Dad through the traffic tangles or onto a form of transit that would, as California's governor had requested, get him to work on time.[16]

[15] *Ibid.*, pp. 140–141.
[16] *Ibid.*, p. 103.

Still another systems project was the supersonic transport (SST). The much-proclaimed techniques of systems analysis did not prevent the SST project from greatly exceeding cost estimates until cancelled in March 1971. One side of the affair was revealed by Senator Proxmire: the Department of Defense spent $12,872 on a children's book called *The Supersonic Pussycat,* in which the lucky cat flew to Paris in just over two hours; "an accompanying teacher's manual suggested exercises which can excite interest in supersonic flight." The amusing aspects of this example do not overshadow the intention of systems planners to manufacture appropriate attitudes under the name of education.

Hoos's valuable study is more than simply a detailed chronicle of system fiascos; she is sensitive both to the philosophical weaknesses of systems theory and to the chilling authoritarian streak its protagonists exhibit. With respect to the first, her description of the multidisciplinary origins of systems theory appears perfectly accurate:

> . . . the approach, as we now encounter it, resembles the geological phenomenon known as "Roxbury puddingstone" in both history and constitution. This formation, located in a suburb of Boston, Massachusetts, resulted from glacial movement, which over the miles and the centuries dragged with it, accumulated, and then incorporated a vast heterogeny of types of rock, all set in a matrix and solidified in an agglomerate mass. Many fragments still retain their original identity and character; some have undergone metamorphosis in varying degrees. In like manner, the systems approach is a kind of mosaic, made up of bits and pieces of ideas, theories, and methodology from a number of disciplines. . . . Common emphasis on wholes rather than parts has encouraged a sort of methodological superstructure . . . that serves to sustain a superficial but spurious impression of epistemological universality and consensus.[17]

With respect to the second feature of the systems approach, its authoritarian potential, her study documents the increasing growth of data banks through which vast amounts of data recorded by numerous government agencies are steadily being coordinated

[17] *Ibid.*, p. 27.

and unified to the point where the total dossier on the total population becomes a possibility. In addition, the systems approach to education, based upon treating the substance of knowledge as something that can be taught automatically by programmed teaching machines and upon treating the school building itself with prisonlike methods of control, has come to resemble the caricatures of the antiutopian literature. That all this represents not progress but social retrogression and devolution does not occur to systems enthusiasts.

Garry D. Brewer's *Politicians, Bureaucrats, and the Consultant* [18] is perhaps the first attempt by a systems expert to confront the failure of systems in action. His work is a study of the experiences of San Francisco and Pittsburgh with systems analysis. Under the Community Renewal Program created by act of Congress in 1959, grants were provided to local governments for the creation of urban renewal plans. The guiding philosophy provided by Federal officials stressed the desirability of getting away from piecemeal, unplanned renewal efforts in favor of more integrated, broad-gauged approaches. The jargon of operations research, decision theory, cost-benefit analysis, input-output studies, information theory, and simulation models was invoked in the study proposals, along with the by-now-familiar exaggerated claims about the capabilities of modern systems methods in planning the future of American cities. The participants and advisers included the usual stellar casts of systems experts, planners, social scientists, and administrators. Both cities received grants of over a million dollars, and for both cities computerized simulation models were developed which were to replicate the demand and supply activities of the housing market. Large numbers of variables were fed into the models, including census data on households, income, race, rent-paying ability; and data on types of houses, their conditions and locations, the demand for housing, and evaluations of neighborhood conditions. In brief, every conceivable relevant

[18] Garry D. Brewer, *Politicians, Bureaucrats, and the Consultant: A Critique of Urban Problem Solving* (New York: Basic Books, 1973).

variable entered the simulation models, and simulation runs were attempted. The results for San Francisco were so unsatisfactory that two more versions were hastily developed, but despite these revisions all participants judged the model to be useless. Distortion was excessive, and the input-output printouts proved virtually unintelligible. Assumptions about the static character of the socioeconomic variables built into the model proved unwarranted. The computer program proved so rigid and expensive as to make almost impossible the alteration of components of the model, and it disregarded long-term structural changes in the demographic features of the city. All participants were unanimous with respect to the failure of the model to approximate what was actually going on.

Although the technical details of the Pittsburgh model differed from those in San Francisco, the results did not. And although the participants considered the Pittsburgh model to be useless for the city planners, and unacceptable as a policy-making or policy-assisting device, it nevertheless was considered to have very promising educational applications. One of the program's builders indicated that he would use it for teaching and research at the University of Pennsylvania; another academic agreed that, although the report was useless from a practical point of view, it was "the best no-cost professional experience one could have ever had," and a third professor incorporated his revised submodel into a METRO urban game he used for teaching purposes at the University of Michigan. It appears, then, that we may expect a generation of city planners and simulations experts to emerge from the universities who have been raised on unworkable simulation models.

In both cities, planning officials developed an intense skepticism about the reliability of consultants who pursued their own enthusiasms and interests while turning in reports of little or no use to officials and of no relevance to the problems originally posed, and who were able to decamp without bearing responsibility for their contributions. But Brewer, a political scientist and a mem-

ber of the senior staff of the RAND Corporation, appears undaunted by these failures; he concludes from the failure of these projects that more and better systems must be developed, applied to bigger and better computers.

Systems thinking has recently emerged in popular culture, partly through the efforts of the Club of Rome. Concern with overpopulation and with pollution has generated interest among systems experts such as Jay W. Forrester, professor at the Massachusetts Institute of Technology and a distinguished inventor of cybernetic devices. Forrester also believes that the social world can be embodied in computer programs. His earlier work on industrial dynamics concerned itself with relatively limited problems, but in his *Urban Dynamics* and *World Dynamics*[19] he moved on to wider horizons. In the first work, he attempted to solve the problems of the city by computer simulation models of all variables considered to affect urban growth and decay. His view of the city suggests an innocence of political and economic realities. He regards the city as "master of its own destiny," and argues that the city can change from within; external factors can be disregarded. But the entire regional-planning movement is based in part on a recognition that urban agglomerations extend far beyond the old municipal boundaries, and that those charged with administering the old municipalities cannot control the regional and national factors affecting them. The men who run American cities know this, and are resignedly aware of the extent to which cities are exploited by their surrounding suburbs and by "upstate" (or "downstate") legislatures. Municipal governments are ridden over roughshod not only by these forces but also by large corporations and by state and Federal bureaucracies.

No empirical work appears to have been done with Forrester's urban models, but his work on "world dynamics" has attracted wide attention. Here he attempted to develop a model for the entire planet, seen from the point of view of population, pollu-

[19] Jay W. Forrester, *Urban Dynamics* (Cambridge: The MIT Press, 1969) and *World Dynamics* (Cambridge: Wright-Allen Press, 1971).

tion, and the exhaustion of natural resources. Invited to a conference by the Club of Rome in June 1970, Forrester was asked to contribute to their project on the predicament of mankind by adapting his earlier systems-dynamics approach. The results were embodied first in his *World Dynamics* and, in a newer and improved model, in the now famous report of the Club of Rome, *The Limits to Growth*.[20] This work, primarily a development of Malthusian assumptions, forecast a collapse of civilization within a century at most, and prescribed the transformation of world society into a unified system.

This work has been subjected to detailed criticism from a number of sources; the rebuttal by a research team at Sussex University under the title *Models of Doom: A Critique of "The Limits to Growth,"* [21] is of especial interest. Their criticism can serve as a model for a critique of the entire systems movement: the model fails to include important mechanisms which are in operation to counter the trends forecasted; it uses world-average figures which fail to fit specific regions of the world, making forecasts that are highly dubious for these specific areas; the system uses approximations that can lead to huge "rounding errors"; the model relies for its forecasts on extrapolations beyond ranges so far experienced in the world; many important assumptions built into the model are either demonstrably false or highly debatable; resources are less depleted than the model assumes; their economic model is based on national accounts data for only one year and is based on implausible assumptions; their population model does not fit actual behavior; and, finally, there is a lack of empirical basis for most of their assumptions.

Most importantly, the Sussex team are aware that the results of the Forrester/Club of Rome analysis come not out of the sys-

[20] Donella H. Meadows and others, *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind* (New York: New American Library, 1972).

[21] H. S. D. Cole and others, eds., *Models of Doom: A Critique of "The Limits to Growth"* (New York: Universe Books, 1973).

tems machinery they use but out of the values and assumptions, beliefs and goals, with which they started before building the systems model.

The Sussex team finds a parallel between the technocracy movement of the 1930s and the systems approach of Forrester: both share the belief that engineering techniques can be used to indicate both the sources of problems and their solutions, and with this a skepticism about the ability of the citizen to understand both the nature and possible solutions of these problems. Third,

> there is the link between scientists and a disinterested but prominent and influential elite. In the case of Technocracy, this elite was composed of businessmen; in the case of the system dynamics group, and appropriately enough in the 1970's, this elite is composed of men who are at the top of various knowledge institutions: research institutes, foundations or management consulting firms. Fourth, there is an immense, and therefore, dramatic simplicity of analysis. Fifth, since both groups share certain messianic qualities—a common faith, shared objectives within the group, and even a desire to proselytize—they can easily be viewed as movements.[22]

The conclusion offered by the Sussex group is that nothing remains of Forrester's and Meadows's efforts that can be used for policy formation by decision makers.

Systems Theory as Ideology

What is the significance of this movement? What, if anything, does it portend, except perhaps the imminent collapse of civilization? As philosophy, systems theory is meretricious, adding nothing to our present condition; as social theory, it is sterile, a mere repetition of old ideas dressed in new terminology—it is simply a disguised version of an older "organic" image of society, which sees social institutions as knit together in a manner analo-

[22] *Ibid.*, p. 193.

gous to the organs of the body, with individuals as "cells" of this body-social, an image going back at least to the Middle Ages.

It cannot be described as empirical science, as there is very little that is empirical about it. Systems thinkers at times seem to be speaking about concrete, "real" systems, be they men, machines, or animals, and at other times seem to mean sets of equations, axioms, and assumption-systems. They habitually retreat from the complexities of social life into finite and logically closed systems which, once constructed, replace the real world. The systems thinker does not attempt to prove that systems "principles," whatever they may be, fit the social world; he merely takes it for granted. The literature is totally one of abstract definitions, conceptualizations, formal structures, and commentaries on other abstract definitions, conceptualizations, and formal structures; nowhere can one find concrete, specific empirical problems that have been defined, studied, worked with, and learned from. The few empirical materials to be found in the literature add up to a pastiche of minor illustrations which prove nothing.

As metaphysics, systems philosophy advances modern philosophy not at all, remaining mired within the Cartesian dualism of mind-body, with endless reiterations of the world view of positivism; it might, in fact, be described as the last agony of positivism, except that its protagonists see themselves as triumphant everywhere. The significance for the history of ideas of this development is still unexplored; that is, the question of how and under what conditions scholars retreat from thought and observation to exercises in vocabulary, as well as the reasons for these exercises being taken seriously.

The systems movement, then, does not survive careful analysis, either as philosophy or as practical technique. The social world —the world of concrete human history—cannot be encompassed in closed logical systems, no matter how large the computer, no matter how many variables are built into the system. Too many convenient and useful simplifying assumptions must be adopted for these systems to even pretend to approximate social realities

in their dynamic and constantly changing complexities. And yet the movement continues. If systems theory is not a coherent theory, nor a usable technique (except perhaps in artificial, limited situations), than what is it? It is, of course, an ideology, and one easily understood by considering the changes that have occurred in American (and world) society since the 1940s. These changes have come to the attention of a number of observers; some recent studies that have taken cognizance of them are: Galbraith's *The New Industrial State;* Vidich's and Bensman's *The New American Society;* Bazelon's *Power in America;* Bell's *The Coming of Post-Industrial Society;* and Kleinberg's *American Society in the Postindustrial Age.*[23] All describe these changes from varying points of view. They describe the growth of government from a relatively insignificant factor to the major force in the economy; the great growth of the social-service sector, to what has been called the administrative state; the growth of giant corporate enterprises both nationally and internationally to the point of their liberation from both governmental fiscal policies in any one country and from their former dependence upon free-market forces. Along with this, they see the shrinking of the market economy and far-reaching changes in the American occupational structure, with more people engaged in white-collar work—administrative, planning, and bureaucratic tasks—than are engaged in manufacturing or other primary production. Rampant technology renders products and even occupations obsolete at an increasing pace. The emergence of new technicians means the rise of a new class oriented toward planning, administration, and technology. Such a class, intoxicated with its own success, and molded by the narrow rationality of its occupational outlook, will naturally strive to give

[23] John Kenneth Galbraith, *The New Industrial State,* 2nd ed. (Boston: Houghton Mifflin, 1971); Joseph Bensman and Arthur J. Vidich, *The New American Society* (Chicago: Quadrangle Books, 1971); David T. Bazelon, *Power in America: The Politics of the New Class* (New York: New American Library, 1967); Daniel Bell, *The Coming of Post-Industrial Society* (New York: Basic Books, 1973); Benjamin Kleinberg, *American Society in the Postindustrial Age* (Columbus: Charles E. Merrill, 1973).

expression to its interests. This expression will, equally naturally, seek to take a form appropriate to American values based on progress through scientific rationality. This old American faith, discerned long ago by de Tocqueville, has been receding somewhat of late but remains strong. The exhaustion of political beliefs, the loss of power of such earlier images of society as the social contract, also combine to create a vacuum into which systems theory moves.

System theory, then, can be understood as an ideology—a claim to power and other social benefits for a specific class called by Galbraith the "technostructure"—in which the claim is disguised in terms of the public good, what Marxists might call a new mystification offered by the new technocrats grasping for power. This group, contemptuous of the untidiness and irrationality of the political process, would prefer to replace the political process by an administrative world, a system which they as philosopher-kings would manipulate from on high, from a position outside of and superior to the system they wish to control. Their writings reek with a sense of their chosenness, their superiority. Out of countless possible passages, one perhaps can be cited:

> The prerequisite of a stable order in the world is a universal body of symbols and practices sustaining an elite which propagates itself by peaceful methods and wields a monopoly of coercion which it is rarely necessary to apply to the uttermost. This means that the consensus on which order is based is necessarily nonrational; the world myth must be taken for granted by most of the population. The capacity of the generality of mankind to disembarrass themselves of the dominant legends of their early years is negligible, and if we pose the problem of unifying the world we must seek for the processes by which a nonrational consensus can be most expeditiously achieved. . . . The discovery of the portentous symbol is an act of creative orientation toward an implicit total configuration.[24]

That systems theory is a claim to total power should be clear, for

[24] Harold Lasswell, *World Politics and Personal Insecurity* (New York: The Free Press, 1965), p. 181.

nothing less than control of a total society will permit the systems theorists to test their claims. But once they achieve this power, there will be no need to test the systems and no way of removing them from control. It does not appear likely, however, that those who hold power will allow the systems theorists to take over; rather, they will use them, perhaps in place of earlier and outworn legitimating images and symbols. In this case, systems theory will contribute but one more misleading image to a world already saturated with such images. Bureaucratic authoritarianism has found its ideology, but one hopes that Americans will not be likely to accept, as "world myth," such a poor counterfeit as systems theory offers. But certainly, before they are forced into the technocratic system, they must know that the systems do not work.